IEEE P802.11
Wireless LANs

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| CR on Beamforming in BTI |
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Abstract

This document proposes resolution for CIDs 1131, 1485, 2298 and 2299 from [1].

These CIDs are related to Clause 10.38.4 Beamforming in BTI [2].

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| **CID** | **Page Number** | **Line Number** | **Comment** | **Proposed Change** | **Resolution** |
| 2298 | 150 | 26 | Within a BTI, should AP complete sweeping of 1 RF chain before moving to another RF chain? | Specify AP completes sweeping one RF chain before send DMG beacon from another RF chain | Rejected-It is implementation dependent. Implementation option 1, AP can complete sweeping of RF chain 1, then starts sweeping of RF chain 2. Implementation option 2, AP can perform SLS on RF chain 1 and 2 with interlaced pattern. As long as AP receives with both RF chain 1 and 2 in the following A-BFT, both implementation options are ok. |
| 2299 | 156 | 15 | If 1 antenna from 1 RF chain requires more than 1 BTI to complete SSW, then multiple RF chain in a BTI is not necessary.If AP uses multiple RF chains in a BTI, it implies AP can finished SSW of antenna 1 of RF chain y in the current BTI and it needs to switch to another antenna 2 of RF chain y in the next BTI. In this case l on L15 should be equal to 1 | specify l=1 in case of using multiple RF chains in 1 BTI, or provide an examples of use case of l>1 | Rejected-The value of L is implementation dependent.Beacon has two purposes: 1, to enable AP discovery; 2, to disseminate some basic element such as schedule element.Consider example 1 (for l>1):For the 2nd purpose, AP can use antenna 1 and 2 in two consecutive BIs’ BTIs. AP can use first BTI primarily for antenna 1’s discovery, and also enable antenna 2 to disseminate schedule element for some STA that is covered by antenna 2 and needs SP in first BI. Then, AP can use second BTI primarily for antenna 2’s discovery and also enable antenna 1 to disseminate schedule element. Example 2:The numbers of sectors to be swept by AP’s antenna 1 and 2, respectively, are different. AP needs 16 beacon frames for antenna 1 while AP needs 8 beacon frames for antenna 2. AP can transmit 12 beacon frames for antenna 1 in 1st BTI. Then, AP can transmit 4 beacon frames for antenna 1 and 8 beacon frames for antenna 1 in 2nd BTI.Example 3:AP needs to sweep over 3 antennas in 2 BIs. AP can have full sweep for antenna 1 and the first half for antenna 2 in 1st BTI. Then, AP can have the second half for antenna 2 and full sweep for antenna 3 in 2nd BTI. |
| 1485 | 150 | 26 | The presence of the sentences "For an EDMG AP or PCP having multiple RF chains, the EDMG AP or PCP mayswitch from one RF chain to another RF chain within a BTI." and "The EDMG AP or PCP shall not changeDMG antennas for the RF chains used within a BTI." in the same paragraph is confusing and seems to place un-necessary restrictions on implementations. The purpose of the standard is to allow interoperability, not to specify how each switch in a device must be set. Many 802.11 devices incorporate antenna switching and they are sucessfully deployed in a way that is compatible with the standard without the implementation details being incorporated into the standard. | Clarify the actual technical reason (if there is one, as I am not sure there is) why it is necessary for an AP or PCP to employ the same antenna array on during the BTI when it obviously is not required to maintain the same antenna pattern. If there is no agreed technical reason, then perhaps it would be better to convert this into informative text on a particular implementation. | Rejected-It follows the technical reason from the rule on DMG AP (in 11ad). “The AP or PCP shall not change DMG antennas within a BTI. In an A-BFT, the AP or PCP shall receive in a quasi-omni antenna pattern using the DMG antenna indicated by the value of the DMG Antenna ID subfield within the SSW field transmitted in the DMG Beacon.” (from REVmd Section 10.38.5.4).The technical reason behind it is as following. An AP needs to ensure that, the STA which has received Beacon from the AP’s one antenna, can be heard by AP in A-BFT with the same antenna. |
| 1131 | 151 | 18 | My understanding is that in general station is allowed to set the TRN-LEN parameter of the TXVECTOR to a value greater than 0 if the PACKET-TYPE parameter of the TXVECTOR is set to TRN-T-PACKET.Why text allow the station to set the TXVECTOR to TRN-T-PACKET for a DMG Beacon frame but require the TRN-LEN to be zero. | Disallow to set the TXVECTOR PACKET-TYPE to TRN-T-PACKET for DMG Beacon. | Rejected-It is not necessary to disallow to set the TXVECTOR PACKET-TYPE to TRN-T-PACKET for DMG Beacon.DMG Beacon is transmitted in DMG control mode. According to 802.11REVmd, in DMG control mode header, “The field (Packet Type = 0 (BRP-RX packet), Packet Type = 1 (BRP-TX packet)) is reserved when the Training Length field is 0.”Thus, when Training Length field is set to 0, it does not matter that Packet Type is BRP-RX packet or BRP-TX packet. |

**CID 2298**

*Comment:*

Within a BTI, should AP complete sweeping of 1 RF chain before moving to another RF chain?

*Proposed change:*

Specify AP completes sweeping one RF chain before send DMG beacon from another RF chain

*Resolution:*

Rejected.

*Discussion:*

It is implementation dependent. Implementation option 1, AP can complete sweeping of RF chain 1, then starts sweeping of RF chain 2 (e.g. in order of 1-1-2-2). Implementation option 2, AP can perform SLS on RF chain 1 and 2 with interlaced pattern (e.g. in order of 1-2-1-2). As long as AP receives with both RF chain 1 and 2 in the following A-BFT, both implementation options are ok.

**CID 2299**

*Comment:*

If 1 antenna from 1 RF chain requires more than 1 BTI to complete SSW, then multiple RF chain in a BTI is not necessary.

If AP uses multiple RF chains in a BTI, it implies AP can finished SSW of antenna 1 of RF chain y in the current BTI and it needs to switch to another antenna 2 of RF chain y in the next BTI. In this case l on L15 should be equal to 1

*Proposed change:*

Specify l=1 in case of using multiple RF chains in 1 BTI, or provide an examples of use case of l>1

*Resolution:*

Rejected.

*Discussion:*

The value of L is implementation dependent.

Beacon has two purposes: 1, to enable AP discovery; 2, to disseminate some basic element such as schedule element.

Consider example 1 (for l>1):

For the 2nd purpose, AP can use antenna 1 and 2 in two consecutive BIs’ BTIs. AP can use first BTI primarily for antenna 1’s discovery, and also enable antenna 2 to disseminate schedule element for some STA that is covered by antenna 2 and needs SP in first BI. Then, AP can use second BTI primarily for antenna 2’s discovery and also enable antenna 1 to disseminate schedule element.

Example 2:

The numbers of sectors to be swept by AP’s antenna 1 and 2, respectively, are different. AP needs 16 beacon frames for antenna 1 while AP needs 8 beacon frames for antenna 2. AP can transmit 12 beacon frames for antenna 1 in 1st BTI. Then, AP can transmit 4 beacon frames for antenna 1 and 8 beacon frames for antenna 2 in 2nd BTI.

Example 3:

AP needs to sweep over 3 antennas in 2 BIs. AP can have full sweep for antenna 1 and the first half for antenna 2 in 1st BTI. Then, AP can have the second half for antenna 2 and full sweep for antenna 3 in 2nd BTI.

**CID 1485**

*Comment:*

The presence of the sentences "For an EDMG AP or PCP having multiple RF chains, the EDMG AP or PCP may switch from one RF chain to another RF chain within a BTI." and "The EDMG AP or PCP shall not change DMG antennas for the RF chains used within a BTI." in the same paragraph is confusing and seems to place un-necessary restrictions on implementations. The purpose of the standard is to allow interoperability, not to specify how each switch in a device must be set. Many 802.11 devices incorporate antenna switching and they are successfully deployed in a way that is compatible with the standard without the implementation details being incorporated into the standard.

*Proposed change:*

Clarify the actual technical reason (if there is one, as I am not sure there is) why it is necessary for an AP or PCP to employ the same antenna array on during the BTI when it obviously is not required to maintain the same antenna pattern. If there is no agreed technical reason, then perhaps it would be better to convert this into informative text on a particular implementation.

*Resolution:*

Rejected.

*Discussion:*

The restriction is necessary. It follows the technical reason from the rule on DMG AP (in 11ad). “The AP or PCP shall not change DMG antennas within a BTI. In an A-BFT, the AP or PCP shall receive in a quasi-omni antenna pattern using the DMG antenna indicated by the value of the DMG Antenna ID subfield within the SSW field transmitted in the DMG Beacon.” (from REVmd Section 10.38.5.4).

The technical reason behind it is as following. An AP needs to ensure that, the STA which has received Beacon from the AP’s one antenna, can be heard by AP in A-BFT with the same antenna.

**CID 1131**

*Comment:*

My understanding is that in general station is allowed to set the TRN-LEN parameter of the TXVECTOR to a value greater than 0 if the PACKET-TYPE parameter of the TXVECTOR is set to TRN-T-PACKET.

Why text allow the station to set the TXVECTOR to TRN-T-PACKET for a DMG Beacon frame but require the TRN-LEN to be zero.

*Proposed change:*

Disallow to set the TXVECTOR PACKET-TYPE to TRN-T-PACKET for DMG Beacon.

*Resolution:*

Rejected.

*Discussion:*

It is not necessary to disallow to set the TXVECTOR PACKET-TYPE to TRN-T-PACKET for DMG Beacon.

DMG Beacon is transmitted in DMG control mode. According to 802.11REVmd, in DMG control mode header, “The field (Packet Type = 0 (BRP-RX packet), Packet Type = 1 (BRP-TX packet)) is reserved when the Training Length field is 0.”

Thus, when Training Length field is set to 0, it does not matter that Packet Type is BRP-RX packet or BRP-TX packet.

Overall, there are 3 cases:

1. Case 1, Training Length=0, Packet Type= reserved (can be either 0 or 1):

A DMG or EDMG AP does not append any TRN subfield to DMG Beacon, DMG STA just receives the Beacon without any BRP-Tx or BRP-Rx training.

1. Case 2, Training Length>=1, Packet Type= 0 (BRP-RX packet):

An EDMG AP does append one or more TRN subfields to DMG Beacon, DMG STA can receive the Beacon with BRP-Rx training. The obtained Rx beam can be used for receiving AP’s signal from the Tx sector which is used for the DMG beacon transmission. Further, if DMG STA has Tx/Rx beam reciprocity,

 The DMG STA can choose candidate Tx beam(s) based on the obtained Rx beam.

1. Case 3, Training Length>=1, Packet Type= 1 (BRP-TX packet):

Since there is no way for STA to report the best beam in BRP-Tx training, this case is meaningless.

Thus, current spec draft allows the aforementioned case 1 and 2. “Text allow the station to set the TXVECTOR to TRN-T-PACKET for a DMG Beacon frame but require the TRN-LEN to be zero”, is to forbid case 3.

**References:**

1. 11-18-0067-01-00ay-11ay-d1-0-comment-database
2. Draft P802.11ay\_D1.0